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Three dune associations compared

Charles B. Atwell

Three small dune areas, far distant from each other, afford some worth-while comparisons of their plant life. The first lies along Seven-mile Island off the New Jersey coast about twenty miles north of Cape May; the second on the west shore of Lake Michigan, near Waukegan, Illinois, forty-five miles north of Chicago; the third on the Pacific coast at Seaside, Oregon, twenty miles south of the mouth of the Columbia river.

On the New Jersey Coast

Seven-mile Island is a narrow strip having, perhaps, an average width of a half mile and cut off from the mainland by a stretch of salt marshes about three and a half miles wide which is indented with shallow tidal channels and inlets from the Atlantic. The island lies in latitude of about thirty-nine degrees, North; has a summer temperature of 70°–75°F. and a summer rainfall of eleven to twenty-one inches, with prevailing winds from the southwest. The dunes on the island with their plant associations are doomed to disappear in a few years because of the rapid growth of the summer-resort villages, Avalon, Peermont and Stone Harbor. The real estate speculator levels the dunes to fill the shallows and marshes and to beautify his property and so bring it into market.

The observations upon which these notes are based were made in the summer of 1923. Examination of cross-sections of the undisturbed dune complex which extends along the island from Peermont to Stone Harbor brings out the following facts.

Along the upper beach and fore dunes, above the ordinary high tide mark, are found frequent clumps of the esculents: sea rocket, *Cakile edulenta*, and seaside sandwort, *Ammodenia peploides;* while, well above the high water mark, the beach grass, *Ammophila arenaria*, and the trailing bean, *Strophostyles hel-*

vola, are abundant and wide spreading. Upon the dune crests, most abundant, are *Ammophila* and two grapes, *Vitis labrusca* and *V. aestivalis;* the black cherry, *Prunus serotina;* the trumpet creeper, *Tecoma radicans*, and poison ivy, *Rhus radicans*, all serving to check drifting sand thus producing dunes which here rise to the height of thirty feet above the sea. Standing upon the dune crests and looking eastward one may see a dune complex with its hillocks and blowouts and projecting snags of red cedar, *Juniperus virginiana*, grave-markers of an ancient forest smothered by wind-swept sands long ago. To the west a dense forest completely covers the lee slopes and extends to the salt marshes.

The tangle of vines, briers, shrubs and scrub oaks render passage through the undergrowth of the forest almost impossible without the aid of a cutting instrument. The term 'forest complex' is altogether appropriate for this plant association. The trees most frequently found are: the two oaks, *Quercus falcata*, and *Q. minor;* the holly, *Ilex opaca;* red cedar, *Juniperus virginiana*, and *Sassafras officinalis*. The common shrubs are the bayberry, *Myrica carolinensis*, and black cherry, *Prunus serotina*, while the vines are: cat brier, *Smilax rotundifolia*, trumpet creeper, poison ivy, and the two grapes mentioned above. On the floor of the forest are occasional, distinctive, large patches of prickly pear, *Opuntia vulgaris*, occurring even where there is a heavy growth of juniper and scrub oaks and consequently much shade.

AT BEACH, ILLINOIS

The south and east shores of Lake Michigan are renowned for their sand dunes and dune complexes extending from Gary, Ind., eastward through Michigan City and northward to the Straits of Mackinac. Efforts being put forth by learned societies and other organization are likely to succeed in securing reservations and protection for a representative portion of the Indiana dunes through favorable state legislation. The dunes along the eastern coast seem likely to preserve themselves by natural causes in spite of the inroads of railroads and summer resorts. On the other hand, the very narrow strip of dunes along the west shore of Lake Michigan, extending, at one time, from Chicago northward through Lake View and Rogers Park to Evanston, and further north, from Waukegan to Zion City, are nearly extinct due to lakeshore erosion, the extension of the suburbs of Chicago and to the encroaching demands of railroads and industrial enterprises using sand for ballast or building purposes.

At Beach, Ill., four miles north of Waukegan, there remains a narrow strip of shore dunes upon what was, doubtless, originally a sand-bar thrown up by the lake. Back of this strip lie the channels, and the many bars and shallows of Dead River Flats. The shallows are always swampy and in wet seasons usually flooded so that the dune strip has a fresh water sea at its front and a fresh water swamp at its back, these conditions much resembling those prevailing at Seven-mile Island, N. J., except that in the latter case the water is salt and disturbed by diurnal tides. Lying under north latitude of about 42° and subject to a summer temperature of 63–77 F., this area has a summer rainfall of ten to twelve inches and a total annual precipitation of thirty-three inches. The prevailing breeze is from the southwest but it is the occasional strong wind from the east or northeast which drives the beach sands landward to form the dunes.

The characteristic plants upon the upper beach are: the beach pea, *Lathyrus maritimus*, the sea rocket, *Cakile edulenta*, the beach grass, *Ammophila arenaria*, and the beach reed, *Calamovilfa longifolia*, the last two serving most successfully as sand binders in early dune formation. Upon the exposed changing crests and fore dunes are also the sand cherry, *Prunus pumila*, the bear berry, *Arctostaphylos uva-ursa*, the creeping juniper, *Juniperus procumbens*, the shrubby juniper, *Juniperus communis*, var, together with the summer grape, *Vitis aestivalis*, and the poison ivy, *Rhus radicans*.

The forest association upon the lee slopes, from which most of the species found upon the fore dunes appear to have been derived, is now much thinned out. It is made up largely of these distinctive species: the oaks, *Quercus velutina* and *Q. alba;* the choke cherry, *Prunus virginiana;* the two junipers, *J. procumbens*, and *J. communis*, var.; the bear berry, poison ivy and the summer grape. Patches of the prickly pear, *Opuntia Rafinesquii*, are not infrequently found in this association. The white pine, *Pinus Strobus*, which formerly appeared scattered along the stabilized dunes has practically been exterminated north of Dead River outlet.

At Seaside, Oregon

The third locality under consideration lies on the Oregon coast about twenty miles south of the mouth of the Columbia river. It was visited during the month of July, 1919, when these observations and notes were recorded, and revisited in September 1931. Here a long stretch of beach sands and ridges is exposed through which the little Neconicum River cuts its way to the sea. The river rises in the heavily forested slopes of the Coast range a few miles back, eastward from the coast. From the river's mouth southward to the base of Tillamook Head is a narrow forested ridge having beach sands and small dunes along its western or seaside front while salt marshes and the meandering river lie along its rear or eastern exposure. Across and long this ridge or peninsula extends a popular summer resort, the city of Seaside. Our notes apply to the plant life on the drifting sands along the seashore, or Clatsop beach, northward from the bathing beach to the outlet of Neconicum River and also to the forest adjacent thereto. Further northward at Gearhart and along the coast the sand dunes are higher and more extensive. Weather records indicate the prevailing winds are generally from the west but in June from the southwest and in July from the northwest. The winds are moisture laden with a rainfall of six to eight inches in the summer and an annual precipitation of about seventy-eight inches.

Here the drifting, black, basaltic sands appear to pile up less rapidly and shift more slowly than do the drier sands of the New Jersey coast or along the western shores of Lake Michigan. Vegetation advances rapidly upon newly formed ridges and usually holds the crests without blow-outs. Back of the ridges or dunes lie the salt marshes incident to the tidal waters which invade the Neconicum and its branches. Thus topographical conditions are produced quite similar to those found upon the New Jersey coast at Seven-mile Island. A summer temperature of 61 to 67 degrees prevails and gentle showers are frequent throughout July. Once a hillock or small dune is fairly established it is soon overrun by invading plant life of the nearby forest. The older sand ridges have thus become well forested and are to be regarded as permanent except as disturbed by the act of man.

On the shifting sands, at and above the high tide mark, the succulent sea rocket, *Cakile edulenta*, var. *californica*, and the beach pea, *Lathyrus maritimus*, grow thriftily in broad clumps; the sand sedge, *Carex macrocephala*, and the beach grass, *Ammophila arenaria*, are most abundant; while the sandwort, *Arenaria peploides*, and the sea verbena, *Glehnia littoralis*, are thrifty but less frequent in the same zone. The growth of all these species serves to check the drifting sand. Thrifty plantations of *Ammophila* now cover the exposed front of the foremost dunes at Gearhart rendering them practically permanent.

On the dune crests the prevailing vegetation consists of the Ambrosia-like *Franseria chamissonis;* the sand verbena, *Abronia latifolia;* the shrubby knotweed, *Polygonum paronychia*, and the bear-berry, *Arctostaphylos uva-ursa*. Here also, less frequent are found *Lupinus littoralis*, the strawberry, *Fragaria chiliensis*, and the morning glory, *Convolulus soldanella*. Dune tansy, *Tanacetum camphoratum*, and the strawberry become superabundant upon stabilized dunes at Gearhart immediately north of the mouth of the Neconicum River.

The forest upon and back of the dune ridge is a dense tangle characterized by the dominance of lodgepole pine, *Pinus contorta*, and the prevalence of devil's club, *Echinopanax horrida*, the hillman root, *Echinocystis oreganus*, the sallal, *Gaultheria shallon*, the salmon berry, *Rubus spectabilis*, the stonecrop, *Sedum oregonum*, and a rich growth of smaller plants including mosses and ferns.

Comment

Similarity of topography is noted in the three areas under consideration. Each is a narrow ridge of shore sands fronting upon a great sea and having at its back a marshland indented with water-channels and shallows. At Seaside and Seven-mile Island the waters are salt and tidal.

Common to all three areas are *Cakile* and *Ammophila* both serving as sand-binders. The latter by means of its leaf clusters, rootlets and branching rhizomes is most successful in checking drifting sand and is extensively planted for that purpose along the west coast.

The perennial beach pea, *Lathyrus maritimus*, abundant both at Seaside and Beach is replaced at Seven-mile Island by the annual trailing-bean, *Strophostyles;* however, the beach pea is to be found on the coast sands of New Jersey somewhat farther north, and is well-known as a beach plant along the shores of all the Great Lakes and the northern coasts of both the Atlantic and the Pacific.

Trumpet creepers and grapevines form tangles and mats upon the dune crests at Seven-mile Island which serve to check erosion from falling rain while no vines are found on the sands at Seaside. Similarly at Beach, mats are formed on the sands by grapevines and more extensively by creeping juniper.

In the forest on the dunes at Seaside the absence of oaks is to be noted. The dominance of lodge-pole pines which become dwarfed, greatly compacted and tangled from the impact of the ocean winds, is remarkable.

Further contrasts of the plant life of the three areas are brought out in the tabulated lists.

THREE DUNE ASSOCIATIONS COMPARED

New Jersey Seven-mile Island	Illinois Beach (R.R.) Station	Oregon Seaside-Gearhart
	High beach sands and fore dunes	
Cakile edulenta	*Cakile edulenta*	*Cakile edulenta var.*
Strophostyles helvola	*Lathyrus maritimus*	*Lathyrus maritimus*
Ammophila arenaria	*Ammophila arenaria*	*Ammophila arenaria*
	Calamovilfa longifolia	
Arenaria peploides		*Arenaria peploides*
		Carex macrocephala
		Glehnia littoralis
	Dune crests	
Ammophila	*Ammophila*	*Ammophila*
		Franseria chamissonis
		Abronia latifolia
		Lupinus littoralis
		Tanacetum camphoratum
Vitis lubrusca		
Vitis aestivalis	*Vitis aestivalis*	
Tecoma radicans		
	Arctostaphylos uva-ursa	*Arctostaphylos uva-ursa*
Prunus serotina	*Prunus pumila*	
	Forest in lee of dunes	
Quercus falcata	*Quercus rubra*	
Quercus minor	*Quercus velutina*	
Ilex opaca		
Myrica carolinensis		
	Populus balsamifera	
Juniperus virginia	*Juniperus procumbens*	*Pinus contorta*
	Juniperus communis	
Smilax rotundifolia		*Gaultheria shallon*

Tecoma radicans	*Arctostaphylos uva-ursa*	*Arctostaphylos uva-ursa*
		Echinopanax horrida
Vitis	*Vitis*	
Rhus radicans	*Rhus radicans*	
Prunus serotina	*Prunus virginiana*	
		Sedum oregonum
Opuntia vulgaris	*Opuntia Rafinesquii*	

San Francisco, California